

## 61 LONG TERM FOLLOWUP OF FRESH OSTEOCHONDRAL ALLOGRAFTING OF THE FEMORAL CONDYLE

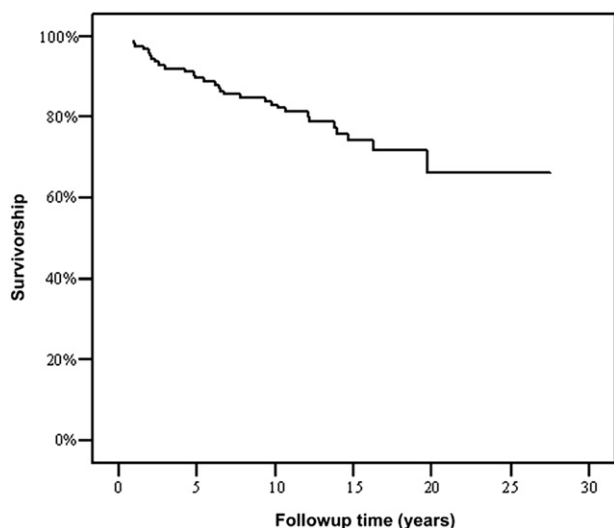
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**Background and purpose:** Articular cartilage injuries of the distal femur are a challenging clinical entity. Fresh osteochondral allografting (OCA) is an increasingly popular option for articular cartilage restoration. Many short-term follow up studies demonstrate promising clinical results, but there are few long-term follow up studies that provide information about graft survivorship and durability. The purpose of this study was to assess long-term clinical outcome, determine frequency and types of reoperations, determine survivorship, and to evaluate predictors of OCA failure in patients undergoing fresh OCA transplantation due to various pathologies.

**Methods:** Since 1983, our IRB-approved OCA outcomes program has collected data on 614 OCA transplantation procedures of the knee performed in 536 patients. Of those, we evaluated 122 patients (129 knees) who underwent OCA transplantation of the femoral condyle, were at least ten years out from the index surgery and had a minimum two-year followup. Mean age was 31.7 years (range, 15–68 years); 85% were younger than 45 years. 53% were male 47% were female. Diagnoses included osteochondritis dissecans (45%), traumatic cartilage injury (22.5%), degenerative chondral lesion (15.5%), avascular necrosis (14.7%), and osteochondral fracture (2.3%). Average total graft area was 8.1 cm<sup>2</sup> (range, 0.7–28.5 cm<sup>2</sup>). Clinical evaluation included the modified D'Aubigne and Postel (18-point) scale, International Knee Documentation Committee (IKDC) pain and function scores, Knee Society (KS) function scores and measures of subjective satisfaction. Reoperations and failures were recorded. Graft failure was defined as revision OCA, or conversion to arthroplasty.

**Results:** Mean followup was 14.2 years (range, 2–27.5 years). Mean 18-point score improved from 12.1 to 16.0, mean IKDC pain score improved from 7.0 to 3.8, mean IKDC function score from 3.4 to 7.2, and mean KS-F score from 65.6 to 82.5 (all,  $p < 0.001$ ). Subjectively, 97% of patients were satisfied with their outcome. Sixty-one knees (47%) were re-operated. Thirty knees (23%) had reoperations not necessarily related to the graft. Thirty-one knees (24%) failed at a mean of  $7.2 \pm 5.2$  years (range, 1–19.7 years). Fifteen underwent revision OCA (48%) and 16 arthroplasty conversions (52%). Kaplan Meier survivorship analysis showed survival rates was 82% at ten, 74% at 15, and 66% at 20 years (figure 1). Logistic regression analysis demonstrated that age  $\geq 30$  years at time of surgery and having two or more previous surgeries in the operated knee were associated with allograft failure.

**Conclusion:** Osteochondral allografting appears useful in treating wide spectrum articular cartilage pathology. OCA resulted in durable improvement in pain and function, with graft survivorship of 82% at 10 years.



## 62 IN SITU CROSS-LINKABLE HYALURONAN FOR CARTILAGE REPAIR

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**Purpose:** We have investigated the feasibility of an in situ cross-linkable hyaluronan hydrogel system for cartilage repair *in vitro* and *in vivo*. The hydrogel system is a two-component system based on aldehyde-modified hyaluronic acid and hydrazide-modified polyvinyl alcohol, which are rapidly cross-linked *in situ* upon mixing of the two polymer components. The chemical modification of this particular hyaluronan formulation is low; approximately 5% of the carboxyl groups of the backbone are modified.

**Methods:** Chondrocytes or mesenchymal stem cells were encapsulated in the gel and cultured in chondrogenic medium for 28 days. The *in vitro* tissue formation was analyzed by histology, immunohistochemistry and dimethylmethylene blue assay for glucosaminoglycan content. The *in vivo* performance of the gel was studied as regeneration of local defects in a rabbit model. A defect of 4 mm diameter was created on the medial femoral condyle in the knee joints of 6 month old New Zealand White rabbits. After assuring access to stem cells from subchondral bone by bleeding, the patella was relocated in position and the knee capsule was tightly sutured before a volume of 0.4 ml of the hydrogel system was injected into the knee joint. The same defect were created on the contralateral knees, but was left untreated to serve as controls. The animals were sacrificed after 3 or 6 months and the joints processed for histopathological examination.

**Results:** We demonstrated that chondrocytes and mesenchymal cells cultured in the hydrogel form cartilage-like tissue, rich in glucosaminoglycans, collagen type II and aggrecan. In the rabbit animal model the injection of the hydrogel improved the healing of full-thickness cartilage defect in the knee as compared to non-treated controls. The *in vivo* study showed that the regenerated cartilage defects stained more intense for type II collagen upon treatment with the hydrogel. Here and in previous studies of bone regeneration using these materials, no inflammatory response or capsule formation has been observed.

**Conclusions:** The results are very promising, and the hydrogel system could be used both for cell based and cell free regeneration therapies. Future studies are aimed to explore and develop a new way to contribute to the repair of impaired bone and cartilage tissue in osteoarthritis. This is based on the known facts that inflammatory stimuli as well as mechanical load contributes to cartilage and bone damage in OA, and that repair demands that the tissue should be supported with 1) adequate biomechanical stimuli 2) suppress destructive inflammation and 3) stimulate regeneration with anabolic factors. The hyaluronan hydrogel system would provide the biomechanical support and ability to deliver anti-inflammatory and anabolic factors to promote regeneration.

## 63 THE CHONDROPROTECTIVE EFFECT OF FGF9 IN AN EXPERIMENTAL MODEL OF OSTEOARTHRITIS

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**Purpose:** To study the chondroprotective effect of local delivery of FGF9 in a rat meniscal tear model of osteoarthritis.

**Methods:** 34 skeletally mature male Lewis rats underwent surgery to create full-thickness transection of the medial collateral ligament and the medial meniscus of the right knee. Two weeks after surgery animals were randomized into two treatment groups: 18 animals received bi-weekly intra-articular injections of 4 µg FGF9 in 50 µl saline for total of 3 weeks. A parallel treatment group included 16 animals that received only 50 µl saline. Three days after the last injection, animals were euthanized and 40 joints (6 normal, 16 surgery, 18 surgery + FGF9) were processed and sections stained with toluidine blue. Quantitative and semi-quantitative histopathological evaluation was performed to assess the osteoarthritic changes of the operated joints and the effect of FGF9 treatment in the medial tibial plateau region. The parameters that were evaluated include: cartilage degeneration score, tibial cartilage degeneration width, cartilage thickness and depth of lesions, semi-quantitative collagen damage assessment, percent proteoglycan loss, and cartilage viability.